## The Country Road.

The making of a road is a matter which is too often undertaken without a knowledge of the real principles involved, and the result has been that, on some sections of many roads, labor and material have been lavished, year after year from time almost forgotten, and still these roads are, each fall and spring, almost impassible. The roadmakers are becoming discouraged, and wonder why their efforts are not successful. A solution of nearly every difficulty, in connection with these bad sections of our country roads is to be found in the fact that every good road has two essential features (a) a thoroughly firm and dry foundation and (b) a smooth, hard, waterproof surface covering.

The foundation of a road is the natural sub-soil, the original "dirt-road," which must be kept dry and firm by means of good drainage. This founda-

tion is firm and strong, capable of supporting any load in dry weather, and the object of the road-maker must be to maintain dry weather conditions as far as possible. This cannot be done economically nor effectually by piling up the natural soil in a mound, higher and higher. Earth is like a sponge, and will soak up from below the water which softens and weakens it.

This means then, that water 'must be cut off before it can be drawn into the road in this way. This can be best accomplished by means of tile drains ; or deep open drains at the side of the road will accomplish much the same purpose. Whether covered tile underdrains or open

drains are employed, they must be real drains, not mere receptacles to hold water. They must have good fall and free outlet, to remove water from the road as quickly as possible.

The surface covering which protects the sub-soil from rain and melting snow, and from the action of wheels and the feet of horses is generally a coating of gravel or broken stone. This should be put on the road in such a way that it will not, in wet weather, be churned up and mixed with the earth beneath. That is, it should form a distinct coating.

To accomplish this, the gravel or stone should be clean, containing little sand or clay. The road should be crowned or rounded in the centre so as to shed the water to the open drains. Ruts should be filled up as soon as they form, as they hold water, deepen and enlarge quickly when neglected. The tile and open drains should, as has been said, have a free fall.

Tile underdrains are not needed

throughout the length of the road in all gr

cases. They should be laid wherever open drains of a safe depth are not sufficient, where the ground has a moist or wet appearance, with a tendency to rut readily and absorb gravel. In some cases they should be run diagonally to the centre of the road if the soil is very spongy; or if a spring appears to exist underneath the road-bed it can be tapped by this form of "blind drain."

The dirt road should be carefully graded and crowned before gravel is placed on it. If a grading machine is available it is well to have a'l its work performed in the early part of the summer, before the ground, if a clay, is hardened and baked by the heat of the sun.

A fair crown for gravel roads, when newly constructed, is a rise of one inch to each foot of width from side to centre. On hills the crown should be greater in proportion to the steepness of the hill, otherwise water will flow down the hill in



The width of the roads of each township should be definitely laid down; and not range from ten to forty feet, as is the rule in most municipalities. A width of twenty-four feet between ditches will meet most conditions, the central eight feet being covered with gravel or broken stone.

Every municipality should make provision for an examination of its roads after heavy rains, and during spring freshets. The work of a few minutes in freeing drains from obstructions, or diverting a current of water into a proper channel may become the work of days, if neglected, as water is very destructive. Surface water should be disposed of in small quantities, not gathered into one long drain, as great accumulations are difficult to handle, and do much injury.

Circumstances must govern each case, but outlets should be obtained into natural watercourses as frequently as possible. Culverts should have a good and free outlet, so that water will not stand and freeze in them. Deep open drains by the roadside are unsafe, and where deep drainage is needed, it is better to use tile underdrains which may be placed below the existing open drains.

A degree of moisture is necessary, in the summer season, in keeping sand roads, or roads over sandy ground in their best condition. In an excessively dry season roads of this kind are apt to "unravel," the gravel or stone covering becoming broken up. Drains



NORTH VIEW OF RESERVOIR AND PUMPING STATION, ST. THOMAS WATERWORKS.

very shallow wheel tracks and quickly deepen them to ruts.

Gravel or stone should not be left on the road just as it falls from the wagon, but should be spread so that travel will at once pass over and consolidate it before the fall rains commence. Gravel or stone should be kept scraped or raked into the wheel and horse tracks until they are thoroughly consolidated. By careful attention to this, in the case of a newly metalled road, the lines subjected to greatest wear will be given almost steellike strength.

Old gravel roads which have a hard centre, but which are too flat, with high, square shoulders, should be repaired by cutting off these shoulders with a grading machine, turning the sod and earth of which they are composed, ditchward and across the open ditch if necessary. A new coating of gravel or stone should then be placed in the centre of the road to round it up to a proper crown. The old are necessary but they should not be deeper, in ordinary cases, than will provide suitable drainage in spring and fall. One of the most lasting and beneficial improvements to sand road is the planting of rows of trees on each side of theroad, and close enough to provide a continuous shade. Evergreens are not suitable for spring; but maples, oaks, white shade theroads in summer only, and do so more effectually than will most evergreens.

A study of the foregoing will point to three main faults, commonly to be found in the roads. These are bad drainage, poor gravel, and improper methods of placing the metal (gravel or broken stone) on the roads. It is doubtful if any of these evils can be fully remedied under the statute labor system. To overcome bad drainage it is essential that there should be a constant system of repairs keeping the road well crowned, free from ruts, the gravel or broken stone raked into place, and the side drains and culverts open and without stoppages. The